

Mine Permit Number M/047/0002
Operator Geokinetics, Inc
TO _____

Mine Name Seep Ridge
Date Sent / Received 8/19/1982
FROM _____

☐ CONFIDENTIAL ☐ BOND CLOSURE ☐ LARGE MAPS ☒ EXPANDABLE
☐ MULTIPUL DOCUMENT TRACKING SHEET ☐ NEW NOI ☐ AMENDMENT
☐ OTHER _____

Description

Record Number

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded
Scope of work, Vegetation, Wildlife
Soils and Reclamation

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

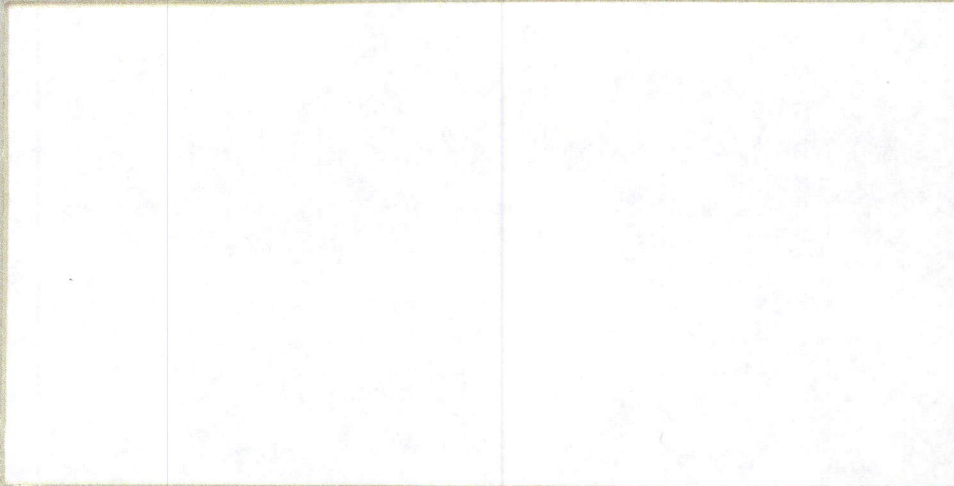
☐ TEXT/ 8 1/2 X 11 MAP PAGES ☐ 11 X 17 MAPS ☐ LARGE MAP

COMMENTS: _____

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8/19/83



MARIAH
ASSOCIATES
ENVIRONMENTAL CONSULTANTS

SCOPE-OF-WORK FOR PROVIDING VEGETATION, WILDLIFE,
SOILS, AND RECLAMATION SECTIONS IN SUPPORT OF
A PERMIT TO MINE ON GEOKINETICS SEEP
RIDGE PROJECT, UINTAH COUNTY, UTAH

Prepared for

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RECEIVED
AUG 19 1983

DIVISION OF
OIL, GAS & MINING

By

Mariah Associates, Inc.
Laramie, Wyoming

August 1983

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1.0 INTRODUCTION

This scope-of-work is prepared in response to Geokinetic's request to provide vegetation, wildlife, soils and reclamation sections pursuant to Utah Division of Oil, Gas and Mining (UDOGM) rules, regulations and guidelines for a mine permit for the Seep Ridge Oil Shale Project in the Uintah Basin of northeastern Utah. The permit sections will be prepared to comply with requirements of the Utah Mined Land Reclamation Act (Title 40-8) and general rules and regulations promulgated under the Act. There currently are no guidelines for baseline studies on oil shale projects that are comparable to the detailed Utah Division of Oil, Gas and Mining (UDOGM) guidelines for studies on coal mines, however, the basic objectives of returning the land to stable ecological condition compatible with land use and minimizing or preventing environmental degradation are the same for both types of projects. The data and information necessary to assure that the objectives are achieved also are very similar for both coal and oil shale projects. Therefore, the proposed studies are based on the coal study guidelines that have been modified as appropriate for an oil shale project. Such an approach will assure that the necessary data are provided while limiting accumulation of unnecessary or unacceptable data.

The objectives of this study are as follows:

- Provide complete vegetation, wildlife and soils baseline studies to comply with the requirements of UDOGM for a permit to mine.
- Develop a practical, cost-effective reclamation plan based on site specific environmental characteristics, mining and engineering plans, and a comprehensive understanding of regulatory requirements and successful reclamation methods.

All data collection and reporting activities proposed herein are pursuant to these objectives. The specific methods proposed are based on

MARIAH'S experience in successfully conducting previous studies of this nature in Utah under UDOGM guidelines. Detailed site-specific studies will be required, however previous studies conducted on the site and the readily available environmental baseline information collected in the surrounding oil shale region of Utah could minimize the extent of certain comprehensive site-specific data collection activities. MARIAH will use the extensive existing data base to the maximum extent possible to satisfy the intent of current rules and regulations and reduce the need for redundant, unnecessary studies.

MARIAH's technical approach to this project is described in detail in this scope-of-work.

2.0 STATEMENT OF WORK

2.1 VEGETATION STUDIES

The "reference area" approach as described in the UDOGM vegetation guidelines will be used during this study. Specific tasks to meet the regulatory requirements are:

- Preparation of Vegetation map
- Vegetation Sampling and Description; Selection of Reference Areas
- Preparation of Vegetation Report

Procedures to be used during each task are outlined below.

2.1.1 Preparation of Vegetation Map

The distribution of vegetation types on the study area (i.e., the permit area) will be delineated on a clean mylar image of an orthophoto mosaic at a scale of 1" = 200'.

The preliminary vegetation maps will be ground truthed and revised during vegetation sampling. All vegetation sample points represent ground truth locations, thereby allowing efficient and accurate ground truthing of the type delineations on affected areas during field sampling. Additional systematic ground truthing of the study area will also be performed. Final vegetation maps that show the distribution of all vegetation types, legal boundaries of the permit area, proposed disturbed areas, reference areas, location of any threatened or endangered plants, and sample site locations will be produced. Maps will be designed and labeled to permit easy access and text reference.

Total acreages of each vegetation type in the permit area and areas to be disturbed will be estimated by standard polar planimeter techniques. Each measurable map unit will be planimetered until three independent measurements are within 10 percent of one another. These three measurements will then be averaged to obtain an estimate for the unit. The indi-

vidual estimates for all units of a specific type will be summed to provide an estimate of the acreage within each type.

2.1.2 Vegetation Sampling and Description, Selection of Reference Areas

Tasks conducted during this phase of the project will be:

- Determine vegetation species composition
- Select reference areas
- Select sample points
- Determine sampling adequacy @ 67%/10% level
- > • Estimate vegetation cover
- > • Estimate shrub density and ~~shrub heights~~ ^{omit}
- Estimate tree density and ~~basal area~~ ^{omit}
- Photograph all vegetation types
- Analyze data

2.1.2.1 Vegetation species composition survey. Reconnaissance-type surveys will be conducted within each vegetation type and reference area to obtain a complete listing of vegetation species by vegetation type for the study area. Surveys will be conducted in conjunction with quantitative sampling for cover data in late August-early September 1983. Specific efforts will be made to locate and identify species listed as noxious weeds, and selenium indicators. A threatened and endangered plant survey has already been completed. Species lists of plants observed during the threatened and endangered surveys and previous vegetation studies in the area will be incorporated with the species list obtained during the 1983 survey. A voucher specimen of each species observed during the 1983 studies will be collected, identified, and labeled. For each plant collected, the date, location, habitat, elevation, and associated species will be recorded.

2.1.2.2 Select reference areas. Reference areas, approximately 1 to 2 acres in size, will be selected for each of the major vegetation types that will be disturbed. Reference areas will be selected on the basis of similarity of species composition, cover, productivity, geology, soils, slope,

and aspect with vegetation types on the areas to be disturbed. Reference sites must be established in areas not to be disturbed by project activities so their selection will be coordinated with Geokinetics personnel. Location of the reference sites will be plotted on the vegetation maps and marked by steel posts in the field.

Reference areas will be selected using an interactive process. This process involves comparison of vegetative cover data from each potentially affected type with data from a corresponding proposed reference area. The comparison utilizes a similarity index for species composition and a t-test for vegetative cover and woody density as defined by UDOGM. If the similarity index is less than 70 percent or the t-test comparison indicates that vegetative cover or woody density on the affected area and proposed reference area are significantly different, another reference area will be selected, sampled, and the data compared to the affected area vegetative cover data. This process will be repeated for each type until an adequate reference area is located. Such an approach assures that proposed reference areas will be equivalent to the types to be disturbed and acceptable to regulatory authorities.

2.1.2.3 Sample site locations. Cover, shrub density, tree density sampling points are located on affected areas using a random sampling technique. This method entails overlaying a grid system (with grid intervals of 1" = 200') on the preliminary vegetation map within the study area. A random numbers table is used to determine grid coordinates and thus sampling points. Each point randomly located by this technique on the aerial photograph is located in the field by pacing from recognizable landmarks. Transect direction will be on a randomly selected compass bearing.

A random selection process is also used on the reference areas. From the northwest corner of the reference plot, a random numbers table is used to determine direction and number of paces from the starting point. This constitutes the first sample point and the starting point for the next sample point (unless the sample points fall outside the designated reference area in which case a new point is selected).

2.1.2.4 Sample adequacy. The following sampling adequacy will be met for estimates of cover, shrub density, and tree density means:

- All at 67% / 10%*
- grasslands - 90 percent confidence, 10 percent precision
 - shrublands and forests - 80 percent confidence, 10 percent precision

(Shrublands are defined as areas where shrubs contribute over 20 percent of the total cover).

However, UDOGM guidelines also require that the number of samples fall within a minimum and maximum number. The approach MARIAH will take will be to sample the minimum number in each vegetation type (i.e., cover and shrubs = 15 samples, trees = 10 samples), and then calculate sample adequacy. If necessary, additional samples will be taken until sampling adequacy has been met or the maximum required number (cover and shrubs = 50 samples, trees = 40 samples) is sampled. This approach will assure that all sampling adequacy requirements are met with the minimum amount of sampling. Total counts of trees and shrubs may be used on reference areas if it is a more efficient approach. Past experience on projects within similar habitats indicates that the minimum number of cover samples is usually sufficient for all except riparian or very sparsely vegetated types, that shrub sampling may require 30 transects, and tree density usually requires approximately 30 points.

2.1.2.5 Vegetation cover. Cover data will be obtained at 50 points spaced at 1 m intervals along a transect at each randomly selected sample point. A linear point-frequency frame (Mueller-Dombois and Ellenberg 1974) will be used to accurately measure vertical hits on vegetation, litter-rock, and bare ground. Crown or shoot cover will be measured by counting only the first interception of the pin with a plant part. Overhead canopy cover will be determined by recording the plant species hit when the vertical line of the pin is projected upward above the frame. Where crowns overlap in layered vegetation, the uppermost layer will be considered the primary vegetation hit and subsequent hits on lower vegetation will be recorded separately.

Data derived by this technique provide an index for vegetative, litter-rock, and bare ground cover by identifying the frequency with which each of these components of total cover is encountered along a given transect. Frequency of occurrence of plant species encountered along each transect is also determined to provide information regarding the relative distribution of vegetative species encountered within each sample unit.

All data will be recorded on standard data forms designed for efficient entry into the computer analysis system. All field data will be collected during late August to early September 1983.

2.1.2.6 Shrub density and heights.

Shrub density and height will be estimated in conjunction with and along the same transects used for cover data. The height, number, and species of shrubs whose stems arise within 50 cm of either side of the 50 m long transect will be recorded. Shrub heights will be measured and recorded by two classes: less than 1 ft and 1 ft or greater.

On certain reference areas, it may be more efficient to conduct an absolute count of the shrubs within the area of known size. The decision to use an absolute count or sample along cover transects will be based on the effects of distribution and density of the shrubs on efficiency of total counts relative to sampling. All data will be recorded on standard forms.

2.1.2.7 Tree density and basal area. The point-quarter technique (Cottam and Curtis 1956; Smith 1974) will be used to collect tree density and basal area data within tree communities on the study area. At each sample point, imaginary grid lines will be used to divide the area into four quarters. The tree nearest to the point in each quarter will be recorded by species, circumference at breast height (in) for those larger than 1 in. diameter (those less than 1 in. diameter are listed as seedlings or saplings), and distance from the point (ft) on a standard field data form. On certain areas, an absolute count or photo count of trees may be conducted. Absolute counts will involve recording the basal area and number of trees of each species within the reference area of known size.

The tree density data will be collected during the same field trip as the cover and shrub data. All data will be recorded on standard field forms.

2.1.2.8 Photographs. All vegetation types will be photographed to provide visual documentation of characteristics.

2.1.2.9 Data analysis and reporting. A comprehensive data base management and analysis system has been developed on a CYBER 730 computer to process vegetation baseline data. This system was developed in response to current regulatory guidelines and will be used for this study with little modification or additional programming. The system is designed to provide accurate and efficient analyses of vegetation baseline data and to generate output in an easily interpreted format commensurate with the data analysis requirements of UDOGM. Key design features of the system are as follows:

- Built-in quality control and assurance checks to ensure all data input and analysis are correct and complete. Data are input via keypunched cards that have been double punched and verified for accuracy.
- Provides printed records of all data input and analysis. Analysis results are printed in a logically organized, tabular format with all parameters clearly labeled.
- Generates permanent records of all raw data and analysis on computer tape for subsequent retrieval, update, and manipulation.
- Can be easily modified to meet project or site-specific data analysis needs (since this system was developed with previous projects and overhead funds, the cost of data analysis is minimized).

All data analysis methods used to estimate means, standard deviations, species frequency and constancy, sample adequacy, etc. are based on commonly accepted, well-documented procedures as provided in the scientific literature and UDOGM guidelines.

The analysis of cover, production, and shrub density data is provided by transect for each vegetation type. A summary of all transects for a vegetation type that includes an evaluation of sample adequacy (species frequency and constancy calculations are provided for cover data, as well) is included. This type of detailed analysis, plus the inclusion of computerized field data sheets, ensures the careful, accurate documentation of every data analysis step from field collection and recording through summary data analysis. It also provides Geokinetics and the regulatory agencies a logical, legible data format with which any result and conclusion stated in the report can be easily verified.

In addition to the analysis discussed above, species composition data are also computerized. Species found on the study area are input to the computer system using 2-5 letter codes and the corresponding scientific and common name automatically retrieved on a master vegetation list currently containing over 1500 species. All species found are cross-referenced by the computer to determine their status as a rare, threatened, or endangered species, a primary selenium indicator, or a noxious or designated weed. A species list that is organized by plant groupings (e.g. grasses, forbs, shrubs, etc.) will be generated.

2.1.3 Preparation of Vegetation Report For The Mining Permit

The vegetation report will serve as the vegetation resources section of the Mining Permit. The vegetation report will provide all information required including:

- Names of organizations that collected and analyzed the data
- Dates of collection and analysis
- Description of methods
- Vegetation maps
- Computer print outs of all field and analyzed data

- Qualitative description of the vegetation types to include discussion on species composition, maturity, past perturbations, correlation with environmental factors, and position in the landscape.
- Quantitative information on canopy coverage, frequency, shrub density, shrub height, tree density, tree basal area, and acres covered for each type.
- Information on threatened and endangered species
- Effects of mining operations on vegetation
- Mitigation and management plans
- Revegetation methods and justifications (coordinated and referenced with reclamation plan).
- Methods and criteria for demonstrating revegetation success.

The format, type style, and map legends of the vegetation report will be coordinated with Geokinetics so that it can be inserted directly in to the permit application.

2.2 WILDLIFE

No specific requirements are given for wildlife data in support of a notice of intention to commence oil shale mining operations. This is in contrast to specific requirements on coal mine permit application for formal consultations with State and Federal Agencies, which are usually conducted and coordinated by UDOGM. Although no specific wildlife data are required for oil shale mine permits, it is necessary to document the wildlife present for pre-development land use, reclamation planning, impact assessment, threatened or endangered species, and consideration of other species (e.g., golden eagles) protected by state or federal laws or regulations. In the absence of specific guidelines as well as lack of formal procedures to define the scope of wildlife studies, a consultation, on an informal basis during the existing information search, will be conducted with UDOGM, Utah Division of Wildlife Resources (UDWR), and U.S. Fish and Wildlife Service (USFWS) to assure the completeness and acceptability of wildlife data presented with the notice of intention to commence mining.

Particular areas of concern for wildlife that must be addressed in the application will be identified during the consultation.

At a minimum, the existing data must be gathered and assembled in a description of the wildlife resources of the area.

2.2.1 Existing Data Search and Consultation

Existing regional and site-specific information will be solicited from the following sources, among others:

- Existing data from previous studies conducted by Geokinetics.
- Bureau of Land Management (BLM) Wildlife data gathered for planning and management.
- Utah Division of Wildlife Resources - Seasonal wildlife distribution and populations.
- Utah Division of Oil, Gas and Mining - Pertinent information submitted in support of mine permits near the study area.
- Oil Shale Supervisors Office - Vegetation and wildlife information on file for the region
- Universities - Vegetation and wildlife information for the area gathered in support of theses, dissertations, or other University research.
- U.S. Fish and Wildlife Service - Status of rare and endangered species.
- Environmental Impact Statements and Environmental Analysis Reports for the region.
- Private sources who are identified as knowledgeable about the area.

The most recent wildlife distribution maps prepared by the UDWR and other data the UDWR has gathered specific to the study area will be

obtained. UDWR biologists familiar with the area will be interviewed. All existing, site-specific wildlife information will be used to help describe the wildlife resources on the project area.

Given the level of detail of previous studies on the area, the familiarity of UDWR personnel with the area as a result of previous visits to the site, and absence of formal consultation procedures for oil shale projects, the most practical approach will be to conduct consultations with the various agencies in conjunction with the existing information search to update the wildlife data base. Methods and results of the previous study will be discussed with the appropriate individual in each agency contacted, any information they have will be obtained, and any additional concerns that they have will be solicited.

2.2.2 Field Reconnaissance

A field reconnaissance of the study site will be conducted to provide additional site-specific wildlife information and, most importantly, to provide background information necessary to interpret existing data and write a comprehensive description of the wildlife resource. During this field reconnaissance, the biologist will identify and note qualitative habitat type characteristics such as location of water sources and rimrocks and general vegetation characteristics that will be used in the description of wildlife resources and their habitat in the study area. All wildlife observed will be recorded and will provide important site-specific information, particularly for non-game species, that will be used in the description. This field reconnaissance will be conducted in conjunction with the vegetation and soils field work.

2.3 SOILS SURVEY

Soils in the study area have been mapped at Order 3 level by the Soil Conservation Service, however, Order 2 level surveys will be required to provide adequate data for the design of soil handling and conservation measures during operation of the mine and for reclamation planning. All procedures for the topsoil resource assessment, including field methods for

soil mapping and sampling, laboratory sample analysis, subsequent data analysis and topsoil stripping depth recommendations, report development, and all necessary volumetric calculations will be in accordance with the current UDOGM regulations. Furthermore, all technical specifications for soil survey operations will be in accordance with the standards of the USDA-SCS National Cooperative Soil Survey (436: Soil Taxonomy 1976 and 18: Soil Survey Manual 1951). It should be pointed out, however, that the Soil Survey Manual has been nearly completely revised and the individual chapter revisions, as published in the National Soils Handbook (NSH), constitute the most recent statement of specifications and these will be followed rather than the outdated 1951 Soil Survey Manual version. MARIAH has been following these newly developed specifications for well over a year.

Soils will be mapped and sampled at the Order 2 level of intensity on study area.

The soil survey will consist of the following tasks:

- Mapping
- Sampling and profile description
- Laboratory analysis
- Reporting

2.3.1 Mapping

Order 2 mapping units will consist mainly of consociations with some complexes. Taxonomic units will be phases of soil series, series taxajuncts, or series variants. Mapping units of highly contrasting soils will be delineated to a two acre minimum, and low contrasting soils (in chemical and/or physical properties) to a five acre minimum. Complexes of soil series will be used when separation of component series is not possible at the scale of mapping. All boundaries of mapping units will be plotted during the field survey.

Each map unit will be fully described and the following items will be addressed:

- map unit symbol
- map unit name
- major map unit components and their percentages
- minor inclusions and their percentages
- slopes
- physiography type
- erosion hazard from wind
- erosion hazard from water
- surface runoff

All mapping units will be correlated with existing Soil Conservation Service soil survey data.

As an additional product, MARIAH will provide to Geokinetics a complete and legible field notebook that describes the soil characteristics (in an appropriate method of field notation) for each hole that is dug during the basic soil mapping operation. This product is standard operating procedure for MARIAH and provides our clients with additional site specific information not normally provided in a soil survey. MARIAH believes this additional product is necessary for several reasons. It provides point specific data beyond the standard sampling location data. This information is invaluable for discussion of soil series range of characteristics, which provide more specific topsoil volume calculations based on percent inclusions as well as major map unit components. It also provides a written record of all field work that can be utilized in any subsequent field reviews initiated by Geokinetics or UDOGM personnel. MARIAH further believes that this product can be developed in a cost efficient manner that does not require significant additional field time. All holes dug are appropriately numbered in the field book and plotted on a base map.

Field mapping will be compiled using the orthophoto base maps to be provided by Geokinetics. The legend of the map will include mapping unit symbols and soil series profile and sample locations.

2.3.2 Sampling and Profile Description

A minimum of one profile per series phase (for both consociations and all components of complexes) will be described and sampled during the field work. If new soils are found, and new mapping units developed for them, these also will have a minimum of one profile described and sampled.

A profile pit at each sampling site will be excavated by hand or preferably by backhoe if available, depending on depth of soil profile as well as accessibility of the sampling site. When hand dug, a profile pit will be excavated by spade to approximately 25 inches. This is generally sufficient depth to expose the solum and some of the substratum. Below this depth, samples will be taken by means of a 3-inch diameter hand auger.

Each profile selected for sampling will be described and sampled to a depth of 72 inches or to indurated bedrock or clay shales, whichever is shallower. In addition, upper portions of paralithic material, where present, will also be sampled for laboratory characterization. This will provide data for consideration of paralithic material for use as a topsoil substitute, if needed. A two-quart sample will be retained for each specific genetic horizon greater than 4 inches thick. Horizons less than 4 inches thick will be combined in the sample with the adjacent horizon which they most closely resemble. Where a major soil horizon is more than 18 inches thick in the lower part of the profile or more than 12 inches thick in the upper part, these horizons will be subdivided and sampled separately. Samples will be taken, placed in clean, polyethylene plastic bags, and air-dried as much as possible at the end of each field day.

In addition, the following information will be described for each pedon site:

- vegetation
- stoniness class
- erosion condition
- parent material
- slope

- relief
- elevation
- physiography
- aspect
- permeability
- drainage
- depth to groundwater
- moisture
- salts or alkali

The following will be described for each horizon of the pedon:

- depth
- color (dry and moist)
- texture (of coarse fragments and fine earth)
- structure (grade, size, type)
- consistency (dry, moist, wet)
- roots (number and size)
- pores (number and size)
- clay films, (number, thickness, occurrence)
- coarse fragments (gravels, cobbles, stones, boulders)
- mottles (number, size, distinctness, color)
- pH
- boundaries (distinctness and topography)

A legal description will be recorded for each sampling site and includes as part of the profile description in the technical narrative. The sampling location will be plotted on the soil survey map and staked in the field.

2.3.3 Laboratory Analysis

All soil samples will be sent to Inter-Mountain Laboratories, Inc., Sheridan, Wyoming (or other laboratory as preferred by Geokinetics) for the soil analyses. Soil sample material will be split so that an archival sample remains for any future testing. This archival material will be pro-

perly preserved in order to avoid any sample contamination. Archival samples will be submitted to Geokinetics upon completion of the project.

2.3.4 Reporting

A final, completed soil resource assessment will be prepared incorporating all existing data and new data in accordance with current UDOGM guidelines. This document will be written for direct incorporation into Geokinetics application for the permit to mine.

The soils report will include an introduction followed by discussion of the general nature of the area, scope and objectives of the study, survey and sampling methodology, mapping unit and soil series descriptions and all attendant maps, legends and data tables.

The profile descriptions will include depth to rock, internal drainage, soil parent material, physiographic position and slope, and climatic characteristics. Additional features of the profile descriptions will be the series classification according to current soil taxonomy, horizon designations and depths, soil colors and textures, structure, consistencies, pH and effervescence, and horizon boundaries. At the conclusion of each profile description will be a section covering the series' range in characteristics, geographically associated soils and their differential, and current land use of the series along with associated vegetation. Use of the newly proposed soil horizon terminology (SCS, Issue 1, Chapter 4, "Examination and Description of Soils in the Field", May 1981) is optional pending consultation with UDOGM and Geokinetics.

Mapping unit descriptions submitted in the report discuss phase characteristics of the soil series as they occur on the site. Included in the mapping unit information will be surface texture, slope erosion characteristics, soil depth and drainage, elevation and climate, parent material, permeability, available water holding capacity, effective rooting depth, and surface runoff. A brief profile description will be presented in lay terminology. Depth to rock and water table will be recorded and presented, as well as interpretation for use such as the SCS land classification, top-

soil suitability and depth, the desirability of segregating surface from subsurface horizons, prime farmland considerations, and possible post-mining erosion hazards.

The report will include an estimate of the volume of topsoil that can be salvaged for reclamation purposes. This will incorporate all existing and new data and result in the preparation of tables of stripping depths and topsoil volumes by mapping units. Stripping depths and volumes will be calculated for the entire affected area.

Included in the technical narrative will be legends which will provide quick reference to the series and mapping units in both alphabetical and numerical fashion. Accompanying tables will summarize the profile and mapping unit descriptions, and provide data for salvageable topsoil depths and volumes over the study area as stated above. A technical glossary and reference bibliography will be included as a feature of this report. The soil survey maps and laboratory data will accompany the technical report as appendices.

All topsoil suitability stripping depth recommendations will be based on a thorough review of all previous and newly acquired laboratory and field data. Soil suitability and stripping depth information will be plotted on a base map (1" = 200').

2.4 RECLAMATION PLAN

The reclamation plan will be prepared pursuant to requirements of Utah Rules and Regulations (Title 40-8). Specific requirements of Rule M-6 (plan and maps), and Rule M-10 (reclamation standards) will be addressed in the reclamation plan. The reclamation plan is highly dependent on mine and operations plan and preparation of the reclamation plan must be closely coordinated with Geokinetics. The Geokinetics operating plan will be reviewed with regard to compliance concerns under the UDOGM regulatory program. Soils, vegetation, and wildlife data, which will be available as a result of the other studies addressed in this scope-of-work, as well as

information such as post-mine land use, final contours, and engineering design and schedule will be needed to develop the reclamation plan.

The reclamation plan will discuss and present the appropriate maps, figures and pertinent information on the following components:

- Temporary and final revegetation.
- Topsoil handling, storage, redistribution, stabilization, and preparation for seeding.
- Design for reclamation test plots.
- Seed and planting mixtures and application rates for specific sites for both temporary and final vegetation.
- Methods and equipment to be used in soil handling, seeding, and planting.
- Mulches, irrigation, and weed and pest control.
- Schedule and sequence of reclamation and revegetation efforts.
- Management of newly established stands and management
- Recommendations for final land use and monitoring of reclaimed areas.
- Estimated costs of reclamation and revegetation.
- Methods to determine revegetation success.

To be successful, reclamation and revegetation efforts must be based on a thorough knowledge of site specific characteristics and a comprehensive understanding of species and methods that can be successfully employed in those sites to re-establish a vegetation cover compatible with and supportive of the post-mine land use. An equally important consideration is familiarity with the application of regulations that govern revegetation efforts. All appropriate revegetation techniques will be evaluated during preparation of the revegetation plan. The plan will be developed and presented with an approach that has been successfully used during past projects conducted by MARIAH

The format, type styles, and map legends of the reclamation plan will be coordinated with Geokinetics so that it can be inserted directly into the permit application.

3.0 SCHEDULE

Careful scheduling of the tasks identified in the Scope-of-Work will be very important to meet the permit submittal deadline. Many of the tasks will be conducted concurrently to take advantage of cost savings due to combining field trips, etc. However, certain tasks (i.e., vegetation sampling) must be conducted during specific seasons. Final reclamation plans must be based on results of other studies and availability of final mining and engineering plans and must be scheduled accordingly. The proposed project will be completed according to the following schedule.

<u>TASK</u>	<u>DATE (1983)</u>
● Vegetation Studies	
- Species Composition	Early September
- Mapping (field)	Early September
- Sampling and Selection of Reference Areas	Early September
- Data Analysis	Late September
- Report Preparation	October
- Draft Report Due	November 1
- Final Report Due	November 15
● Wildlife Studies	
- Field Reconnaissance (coordinated with vegetation studies)	Early September
- Existing Data Search and Consultation with Regulatory Agencies	Late August-Early September
- Report Preparation	October
- Draft Report Due	November 1
- Final Report Due	November 15
● Soil Studies	
- Field Work	Early September
- Laboratory Analysis	Late September
- Data Analysis	October
- Report Preparation	October
- Draft Report Due	November 1
- Final Report Due	November 15
● Reclamation Planning	
- Site Reconnaissance (coordinated with other studies)	September
- Preparation of Preliminary Methods and Species/Planting Lists	September
- Final Reclamation Planning	October-November
- Draft Reclamation Plan Due	December 1
- Final Reclamatin Plan Due	December 15

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8/19/83

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BILL HUMPHRIES

LAW ENGINEERING TESTING CO.

J. L. Grant

Law Engineering Testing Co

T. Munson

DOGM

Tom Tetty

DOGM

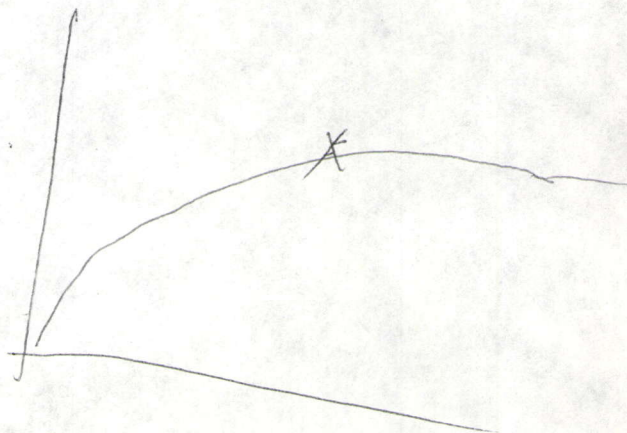
phase I
See Bridge - phase II
woods canyon \Rightarrow 2 phase permit
approach

Address comments directly to Bill Sharrer

section 2 # 32

5 veg-types

67% conf. $\pm = 1.0$



3
1.6
1.6
3.2
1.6
2.56

8/20/83

Memo

To: Tom T

From: Lynn

Subj: Geokinetics Baseline data Collection & Monitoring
Date: August 24

Baseline data collection:

As per the "scope of work" presented by Mariach Associates for Geokinetics, the plan should provide all necessary data to establish Revegetation Success Standards.

Monitoring:

The monitoring plan outline is satisfactory except as follows:

1. need details on vegetation test plot monitoring
2. need details on revegetation monitoring